Southern Sweethearts

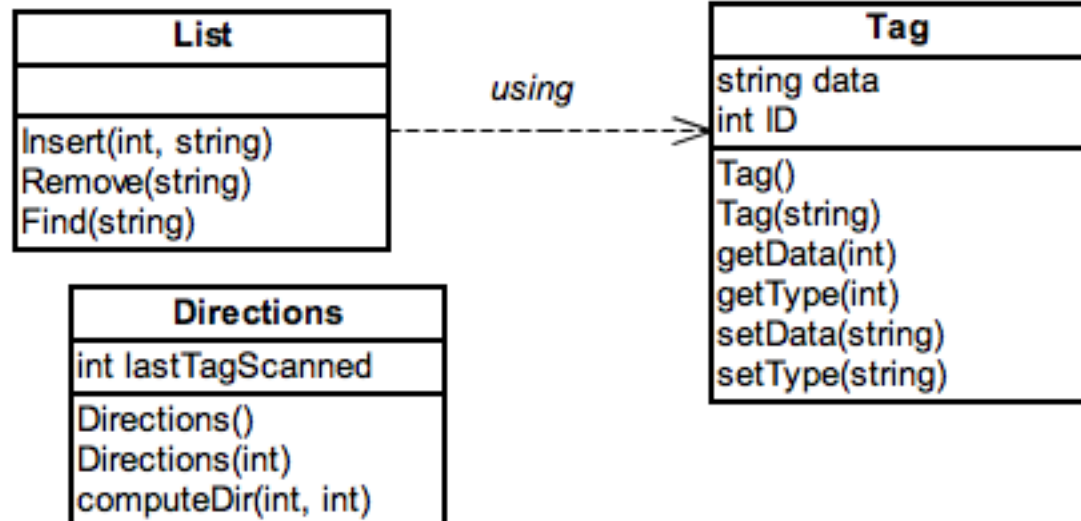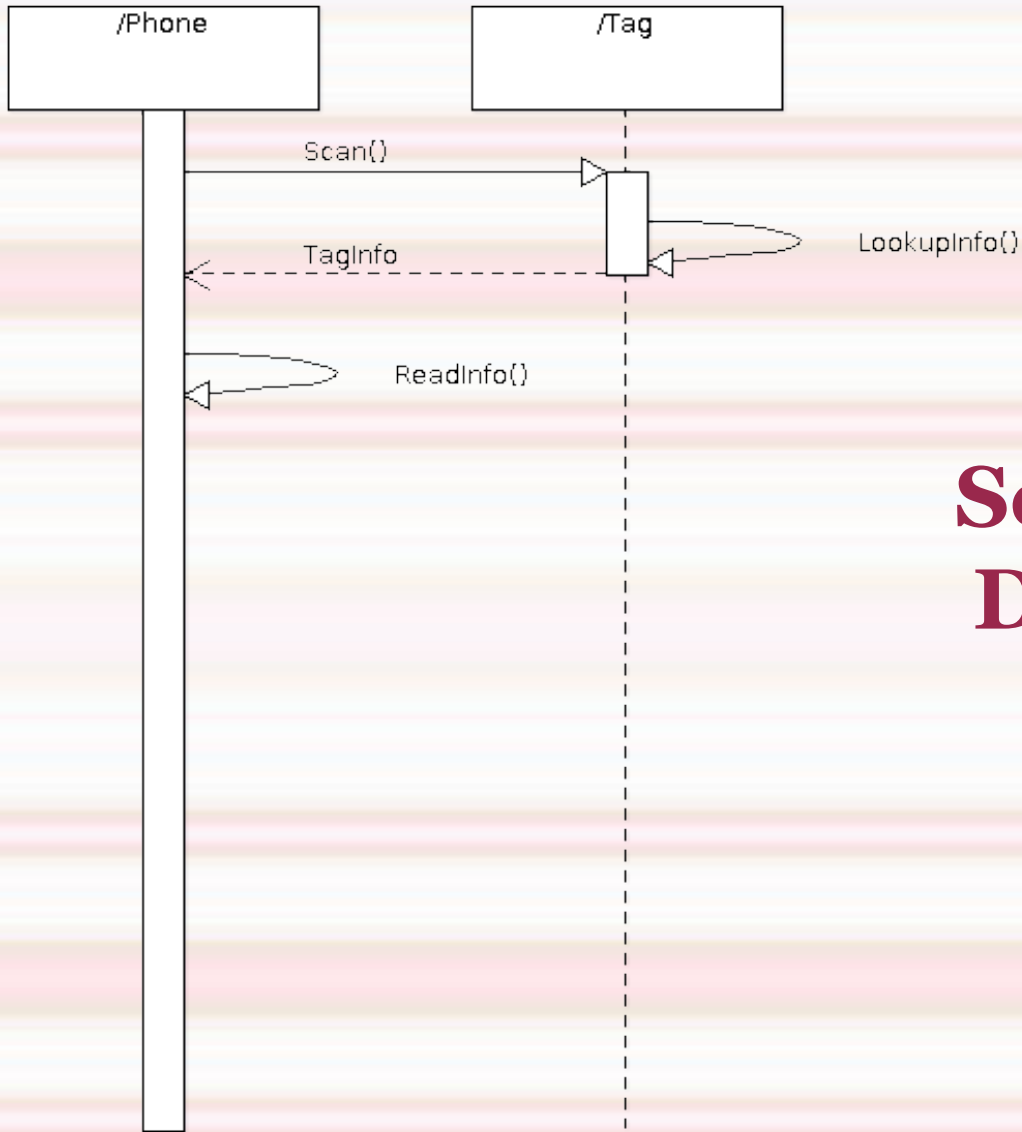## digital eyes

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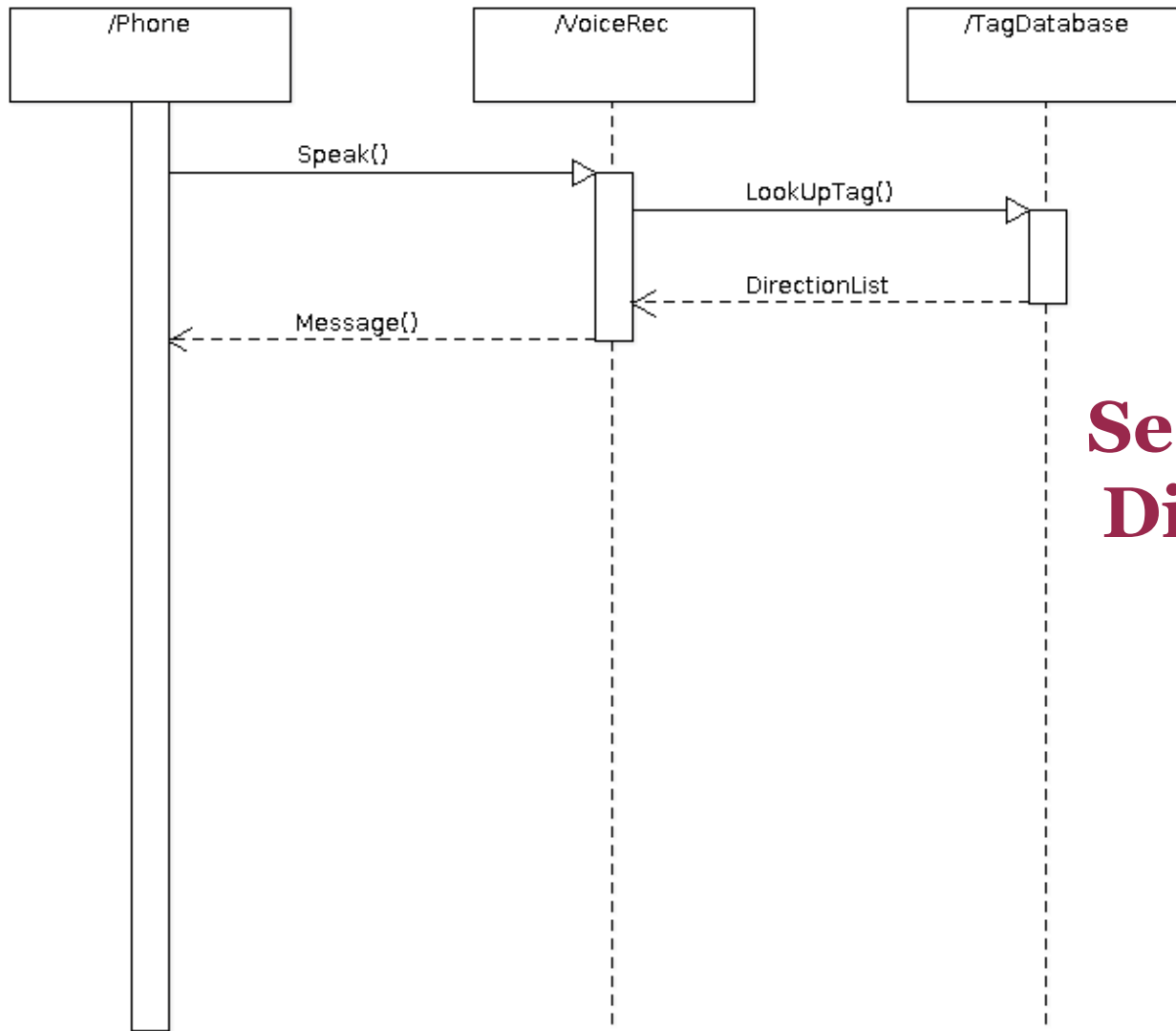Melissa Bowman

Overall Class Diagram

List is used to store tags for a building. They will be in a preset order for directions

List

Insert(int, string)
Remove(string)
Find(string)

using

Tag

string data
int ID

Tag()
Tag(string)
getData(int)
getType(int)
setData(string)
setType(string)

Directions

int lastTagScanned

Directions()
Directions(int)
computeDir(int, int)

/Phone

/Tag

Scan()

LookupInfo()

TagInfo

ReadInfo()

Sequence Diagram

Sequence Diagram

Collaboration Diagram

DIGITAL EYES
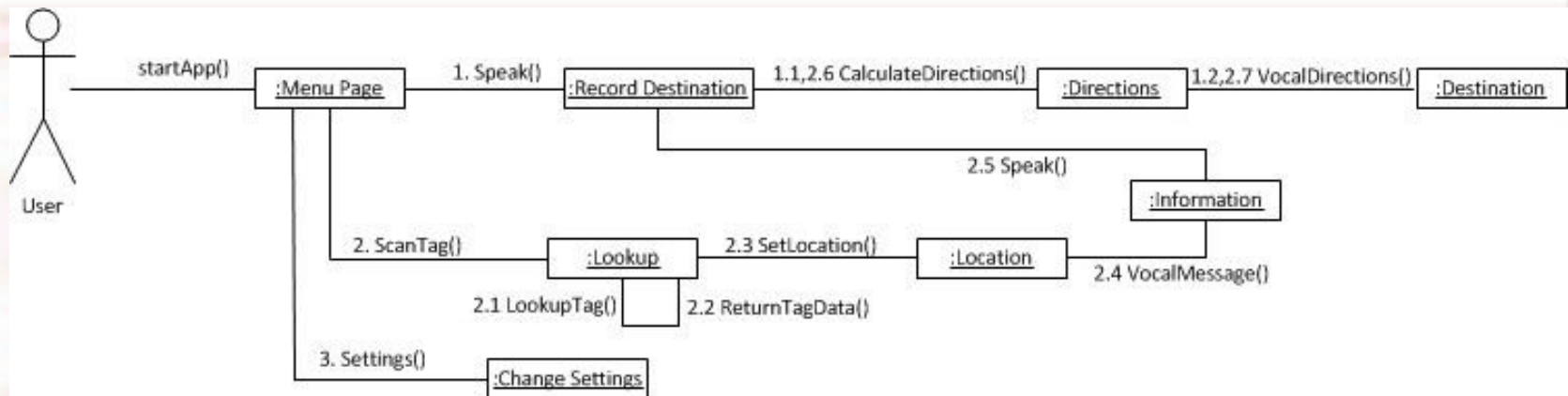
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Problem

Every 7 minutes someone in the United States loses their sight. According to the Research to Prevent Blindness, there are fifteen million blind and visually impaired people in the United States alone. The Braille Institute states that visual impairments affect the lives of nearly five million preschool-age children and approximately twelve million school-age children. To put those numbers into perspective, one in twenty children age three to five and twenty-five percent of children from the ages of six and seventeen are affected by a vision problem. With a visual impairment, one has to discover a way to navigate through the world. Only two percent among the legally blind use a guide dog and only thirty-five percent use a directional long-cane to guide them. This leaves sixty-three percent of the visually impaired with a need for an alternative guide. There is a deep need for new research that can advance the technology offered to those who are challenged by mobility and navigational restrictions. Several technology options exist to assist the visually impaired in navigating outdoors. Such technologies are often based on GPS and location-aware sensing. However, such an approach does not work indoors where the satellite signal strength is too low. If those affected by visual impairments had access to technology that could help them navigate throughout buildings and increase the perception of their surroundings, they could be assisted with common daily tasks that they encounter related to work or general activities.

Project Flow

Activity Diagram 1

Digital Eyes

Project Details: Our project is a Windows Phone 7 application that assists the visually impaired navigate inside buildings. The application interfaces with posted Microsoft Tags and guides the user to their specified destination inside of a building.

Possible Destinations:
- Common features of the building:
  - Restrooms
  - Nearest exit
  - Vending machines
  - Room numbers

Navigation within buildings:
Our product is unique for several reasons. Although GPS is included on almost every Smartphone, navigation within buildings is not currently well supported. With Digital Eyes, we are combining indoor navigation using tag technology and the phone's on-board accelerometer to create a more interactive experience for the user.

Vocal interaction with phone:
The application will be accessible fully through vocal commands. A user of our technology will be able to hear information about rooms and other points of interest within a building. Our product also allows users to set restrictions for their navigation around the building, such as avoiding stairs.

The experimental evaluation of our project will be performed by:
1) classmates who will use the system blindfolded, and
2) students on our campus, identified by the Office of Disability Services, who are among those in the target population of vision impaired students.

Calculating the User's Path

Activity Diagrams 2

Technical Details

Technology Used:
- Microsoft Tags (associated with Microsoft Tag Reader)
- Voice recognition
- Phone with the Windows Phone 7 operating system
- Routing algorithm to determine the shortest path to the user's desired destination

Application Requirements:
- Internet Access

Project Details:
- The user will interact vocally with the application
- Keywords such as 'find restroom', 'find room 345', or 'exit' will be captured by the phone's microphone
- The phone will respond with verbal step by step directions to obtain the intended destination
- The user's starting location, or current location, will be determined by the user scanning a Microsoft Tag, placed directly above the existing Braille room tags.
- Any movement the user makes will be tracked using the phone's accelerometer. It will track the user as they proceed to their destination and voice the next instruction as the user approaches the appropriate area.
- The user can also simply request information about their current location by scanning the nearest Microsoft Tag. The phone will read the room information out loud using text-to-speech.

Windows 7 Phone scanning a Microsoft Tag

Determining Current Location of User

Activity Diagram 3

Conclusion

Digital Eyes has the potential to be a transformative technology offering practical capabilities as a navigational aid for the visually disabled. There are also many intriguing and extremely viable options for future expansion of the application.

About the Users:
- Used mainly by the visually impaired as a navigation aid inside of buildings.
- Intends to make navigation easier for those with partial or total visual disability.
- Though the application's core impact will be focused toward helping the visually disabled gain independence and mobility, this does not preclude others from using the application. Vocal directions also could be used by sighted users. The application could be used by anyone who needs to find their way through an unfamiliar or confusing building complex. The application's directions could also be very useful for those who are frequently lost inside of buildings.

Future:
- Onscreen map: Map will follow user's movements inside of the building. This will be useful for users with partial or no vision impairment, giving them additional information about their environment and final destination.
- Verbal warnings: Addition of warnings about possible safety risks inside the building. The user will be warned vocally about dangers which would otherwise be unknown to the visually disabled.
  - Examples of this would be posted warnings signs, open stairwells, or any other possible dangers in the building.

Free Download:
- The Digital Eyes application will be available as a free download via the Windows 7 App Marketplace.

Easy to Use:
- Initial implementation: Digital Eyes will be preloaded with maps and Microsoft Tags for the Science and Engineering (SEC) building.
- Final implementation: User will scan the Microsoft Tag at the entryway to any tagged building. Application will automatically reference the appropriate map and Microsoft Tags for that building.

Questions or Comments?